(7)

CATALYST COMBUSTOR

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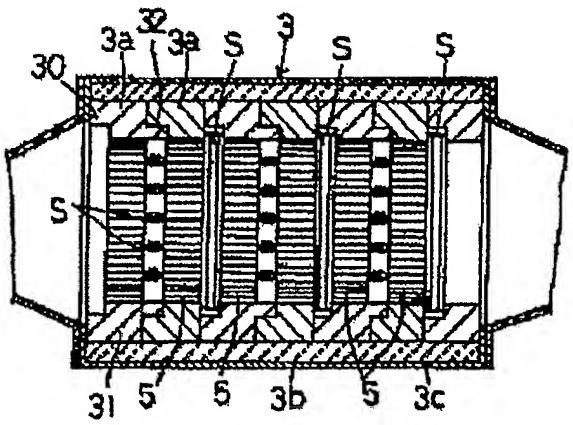
Abstract of **JP5231608**

PURPOSE:To permit the treatment of gas of a large capacity by a method where in the concentration of stress due to thermal strain and the like in combustion catalyst is reduced, the concentration of hydraulic pressure on one part of the combustion catalyst near a rear stage is prevented and the diameter of a catalyst combustion chamber is increased without spoiling the catalytic performance of reducing the generation of NOx and the like while preventing deformation and/or cracking even under an using condition at a high temperature.

CONSTITUTION:In a catalyst combustor provided with a plurality of combustion catalyst bodies 5 having a multitude of penetrating holes in the direction of a flow passage in a tubular member 3 forming the flow passage in parallel along the direction of the flow passage, the combustion catalyst bodies 5 are fitted into the tubular members 3 loosely while the tubular members 3 are provided with retaining members S precluding the movement of the combustion catalyst bodies 5 in the direction of the flow passage by abutting against the end faces of the flow passage direction of the combustion catalyst bodies 5.



* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]Two or more combustion catalyst bodies (5) which have many breakthroughs in said passage direction inside a cylindrical member (3) which forms a channel, it is the catalytic combustion apparatus installed side by side along said passage direction -- said combustion catalyst body (5) -- it fitting in loosely in said cylindrical member (3), and each being ****(ed) to the passage direction end face of said combustion catalyst body (5), and, A catalytic combustion apparatus which has provided an attachment component (S) which prevents that said combustion catalyst body (5) moves to said passage direction in said cylindrical member (3).
[Claim 2]The catalytic combustion apparatus according to claim 1 in which said attachment component (S) is a construction member (S5) over which two or more places of said cylindrical member (3) are built.
[Claim 3]The catalytic combustion apparatus according to claim 2 which said construction member (S5) fits into a slot (33) in which an end is provided at two or more places of said cylindrical member (3) gently, and is constructed over said cylindrical member (3).
[Claim 4]An outer frame member (8) which said cylindrical member (3) demarcates the entrance-side end face (301) and the outlet side end face (302) of a catalyzed combustion room (300), and demarcates a peripheral wall section (303) of said catalyzed combustion room (300), It is allocated in the inside side of said outer frame member (8), and more than one are installed in said passage direction side by side, While it comprises a seating-rim member (7) pinched between said entrance-side end face (301) and the outlet side end face (302) and station keeping of said seating-rim member (7) of the upstream is carried out by seating-rim member (7) of the downstream in a passage direction, said combustion catalyst body (5) allocated by position from which each of said seating-rim member (7) differed in said passage direction -- the catalytic combustion apparatus according to claim 2 or 3 which supports each

via said construction member (S5) individually.

[Claim 5]The catalytic combustion apparatus according to claim 2, 3, or 4 currently allocated by said construction member (S5) which said two or more construction members (S5) comprise a straight-line bar member, and is allocated in the upstream differing in a phase about 90 degrees to said construction member (S5) allocated in the downstream.

[Claim 6]The catalytic combustion apparatus according to claim 2, 3, 4, or 5 by which a split shape is carried out to plurality towards a channel and said combustion catalyst body (5) crossing at right angles.

[Claim 7]The catalytic combustion apparatus according to claim 1 said attachment component (S) not only supports an outer peripheral part of a combustion catalyst body (5), but provided with a catalyst supporter which also supports the center side part of said combustion catalyst body (5).

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]From advance of the environmental pollution by NOx generated from burning appliances, development of the large NOx restraint means in a combustion process is desired. As one of NOx restraint means, the premixing catalytic combustion method using the combustion catalyst of the honeycomb shape which has many breakthroughs in a passage direction is 1100-1300 ** in temperature, and it is known that stable combustion can be attained, controlling generating of NOx to a degree very much. Using this feature as a means afterburning the exhaust fuel of a fuel cell and air gaseous mixture, as a super-low NOx achievement means of a gas turbine, or the application to a boiler, an industrial burner, etc. is considered. This invention relates to the above catalytic combustion apparatus for low NOx, concerning the catalytic combustion apparatus which installed two or more combustion catalyst bodies which have many breakthroughs in the passage direction side by side along the passage direction inside the cylindrical member which forms a channel.
[0002]
[Description of the Prior Art]Conventionally, it has succeeded in development of the tabular combustion catalyst body which supported the precious metals, such as palladium and platinum, to the cordierite honeycomb base via coating materials, such as alumina. Although cordierite honeycomb bases are abbreviation 1.4×10^{-6}/** and a material which becomes and is made low about a coefficient of thermal expansion, maximum service temperature shall be 1400 ** or less, and there is a problem in elevated-temperature use. In the catalyst of this composition, when it exceeded 1000 **, there were problems, like activity deterioration happens that the precious metals carry out evaporation vaporization, by causing the fall of the specific surface area by sintering advance of a coating material, etc.
[0003]Then, this artificer used the palladium cordierite combustion catalyst body for the low

temperature part of the preceding paragraph, and have proposed the catalytic combustion apparatus which has arranged the manganese substitution type stratified aluminate catalyst body from the middle to the latter hot section. The melting point is not less than 1600 **, and also in 1300 **, a manganese substitution type stratified aluminate catalyst body maintains high specific surface area over a long period of time, and has the feature which is easy to maintain high activity.

[0004]In such [conventionally] a structure, the combustion catalyst body formed the whole section vertical to a passage direction in wrap tabular, respectively, it is in the state which pasted up the circumference on the cylindrical member, and this was set, put in order and allotted to the passage direction in the gap. These gaps restrict the thickness of each catalyst body, carry out the duty which lessens the temperature gradient of a thickness direction and stops heat stress small, and they are also carrying out the duty which prevents the increase in the ventilation resistance by gap of the breakthrough between each catalyst body.

[0005]

[Problem(s) to be Solved by the Invention]However, since a combustion catalyst body would be prevented from following a temperature change and carrying out expansion contraction freely if a combustion catalyst body is fixed to a cylindrical member where the circumference is pasted up on a cylindrical member, there was a possibility that heat stress might arise and a combustion catalyst body might be damaged. Make the circumference of a combustion catalyst body fit in loosely as this measure, without pasting the cylindrical member 3, as shown in drawing 14, and. For example, although the trial which misses said heat stress by making the metal spacer 9 of ring shape fit in loosely between the ****** combustion catalyst bodies 5 in a cylindrical member, and securing said gap is also made, In such composition, the hydrostatic pressure added to the combustion catalyst body 5 was added to the combustion catalyst body 5 of the downstream one after another via the metal spacer 9 from the upstream, and there was a danger of big power having concentrated on the combustion catalyst body 5 of a final stage, and damaging this. It was easy to produce the difference in temperature in the portion to which the metal spacer 9 contacts the combustion catalyst body 5, and the portion not contacting, and there was also a possibility that this might promote said breakage.

[0006]In order to make more practical the above-mentioned high-temperature-combustion catalyst body, it is necessary to attain large scale-ization of combustion. Then, without spoiling the performance of low NOx formation, in order to enlarge the amount of gassing of the combustion catalyst body 5, it is necessary to enlarge area of a catalyst body but, and a limit is among the sizes which can carry out integral moulding naturally, maintaining the dimensional accuracy and intensity of a honeycomb. For example, not only intensity but high activity is needed, and 200 mm in diameter or the size of about 200 mm squares is made into the limit per square inch by the combustion catalyst body which needs 200 or more in the number of

cells.

[0007]Then, until now for example, a small catalytic combustion apparatus is manufactured, and examination which attains large scale-ization is made by the method of pasting up or joining the plurality of the segment of the honeycomb catalyst of the size within the method of connecting in parallel with a multi-mold, or the size of the diameter of 200 mm, and increasing a cross-section area.

[0008]However, since the whole device becomes complicated greatly, the catalytic combustion apparatus of the multi-mold linked to the former parallel serves as a high cost, and maintenance control is not easy for it, either. Therefore, it is lacking in practicality. Although the latter conjugation method was a method of using the material in which combustion catalyst bodies differ for adhesion, since the combustion catalyst body was used at the temperature over 1000 **, there was a fault which is easy to cause degradation of a joined part by both solid phase reaction. What the adhesion method using a material of the same kind can inhibit the solid phase reaction between materials for, It originates in the heterogeneity of thickness, so that the thickness of a cohesive site is difficult to make it equivalent to the wall thickness of a cell and the length of an adhesion side is large, although there are advantages, like the coefficient of thermal expansion of the material itself can be made the same, A mechanical strength and temperature distribution became uneven and, for this reason, there was a problem which a crack tends to generate in near a cohesive site. In the combustion catalyst body of manganese replacement layer-like aluminate with a larger coefficient of thermal expansion than the combustion catalyst body of 6 - 8x10 $^{-6}$/** and a cordierite honeycomb, especially since heat stress becomes high several times, this problem is important.

[0009]There is a possibility of damaging a honeycomb catalyst also by concentration of the stress resulting from the difference in the coefficient of thermal expansion of a metal spacer and a honeycomb catalyst or thermal conductivity or the difference in a mechanical strength.

[0010]The purpose of this invention lessens concentration of the stress by said thermal strain in a combustion catalyst body, and. it protecting, and further, for example that hydrostatic pressure concentrates on some [near the latter part] combustion catalyst bodies, even if it is a combustion catalyst body with a small mechanical strength like an above-mentioned honeycomb catalyst, Without spoiling catalyst performances, such as low NOx formation, preventing the modification and crack under a hot service condition, the path of a catalyzed combustion room is enlarged and it is in providing the catalytic combustion apparatus which can process mass gas.

[0011]

[Means for Solving the Problem]In order to attain this purpose, having provided an attachment component which prevents that fit in loosely in a cylindrical member, **** each combustion catalyst body to the passage direction end face of a combustion catalyst body, and a

combustion catalyst body moves to a passage direction in a cylindrical member has the feature composition of a catalytic combustion apparatus by this invention.

[0012]

[Function]Since, as for a combustion catalyst body, the circumference is not restrained and the expansion contraction by heat is permitted when the attachment component which prevents that fit in loosely in a cylindrical member, **** each combustion catalyst body to the end face of the passage direction of a combustion catalyst body, and a combustion catalyst body moves to the thickness direction is provided in a cylindrical member, it is hard to produce heat stress in a combustion catalyst body. Since the hydrostatic pressure added to each combustion catalyst body is caught by the attachment component which supports the combustion catalyst body, The hydrostatic pressure added to a combustion catalyst body is added to the combustion catalyst body of the downstream one after another via a metal spacer like the case in the conventional composition made to fit loosely into a cylindrical member from the upstream, and a catalyst body and a metal spacer can avoid a risk of big power concentrating on the combustion catalyst body of a final stage, and damaging this. Since fear of composition which supports two or more places of the periphery of a combustion catalyst body, for example of breakage decreases for an above-mentioned reason, large caliber-ization becomes easy to some extent, but an attachment component. If the catalyst supporter which supports the main flank of the diameter direction of a combustion catalyst body to an attachment component is formed, it will become easy to large-caliber-ize the section of a catalytic combustion part combining the combustion catalyst body which has restriction in a size, preventing breakage of a combustion catalyst body. For example, although the large-sized combustion catalyst body (what combined with tabular the combustion catalyst body in which two or more molding is possible) which cannot be formed in integral moulding is constituted, The segment of the shape where the circular section vertical to the channel of a corresponding large caliber cylindrical member was divided into plurality is fabricated individually, it can fit loosely into the cylindrical member of said large caliber, and what compared these, without using adhesives and was made into the predetermined form can also be held. Since it will be easy to form a catalyst supporter in an attachment component if an attachment component is formed by the member over which two or more places of the cylindrical member were built in that case, major-diameter-ization of a combustion catalyst body becomes easier. Since thermal expansion contraction of an attachment component is permitted when the end of an attachment component is made to fit into the slot formed in two or more places of a cylindrical member gently and it constructs over a cylindrical member, even if it uses the attachment component made from ceramics, for example, the attachment component itself can be protected from breakage by heat stress.

[0013]

[Effect of the Invention]Conventionally, since the gap between the combustion catalyst bodies secured using adhesives and metal spacers is securable by an attachment component in this application, Since each combustion catalyst body itself can be held in the state of permitting that thermal expansion, by an attachment component while this gap can also protect the increase in the ventilation resistance by gap of the breakthrough between each combustion catalyst body, heat stress can be prevented from occurring in this. Therefore, it becomes easy to prevent breakage by the heat stress of a combustion catalyst body. The hydrostatic pressure added to a combustion catalyst body is added to the combustion catalyst body of the downstream one after another via a metal spacer from the upstream, and the danger that big power will concentrate on the combustion catalyst body of a final stage, and this will be damaged can be avoided. Since this can be held in the state of permitting the thermal expansion, by an attachment component even if it forms a big catalyst body only by comparing again, without doubling two or more segments in comparatively small adhesion side or plane of composition, or using adhesives etc., heat stress can be prevented from occurring. That is, since a combustion catalyst body can be divided into a comparatively small segment and can be constituted even if it is a mass burner, compared with the big combustion catalyst body at one, the destruction whose rate of expansion of each segment is the same but expanding quantity becomes small and according to heat stress also by this becomes difficult to take place.

[0014]As a result, even if it is a combustion catalyst body with a small mechanical strength like a honeycomb catalyst, for example, Having lessened concentration of the stress by a thermal strain etc. and preventing breakage, without spoiling the performances of the catalyst itself, such as low NOx formation, the path of the cylindrical member was able to be enlarged and the catalytic combustion apparatus which can process mass gas was able to be provided.

[0015]

[Example]Hereafter, based on figures, the example of the catalytic combustion apparatus by this invention is described. The axial cross section of a catalytic combustion apparatus is shown in drawing 1. A catalytic combustion apparatus along the channel of combustion gas The combustion chamber 1 for preheating, and the mixing chamber 2 of thin fuel gas, The catalyzed combustion room 300 formed of the cylindrical member 3 and the discharge part 4 of combustion gas are formed in order, and the plurality of the disc-like combustion catalyst body 5 which comprises the honeycomb catalyst which has many breakthroughs in a thickness direction is arranged in in said cylindrical member 3 along a channel, and it has allotted. The cylindrical member 3 is made the composition which reinforces with the iron cylindrical outer frame 8 the container liner-like member 7 which carried out compression molding of the elevated-temperature heat-resistant ceramic fiber. Each combustion catalyst body 5 attaches to said cylindrical member 3 the locking member S1 of the shape of two or more bolt which

penetrates the container liner-like member 7 and projects inside, and has formed it as the attachment component S to the combustion catalyst body 5 while it fits loosely into said cylindrical member 3, Said attachment component S is made to **** to the end face of the combustion catalyst body 5, and it has prevented that the combustion catalyst body 5 moves to the thickness direction. Here, the iron cylindrical outer frame 8 works as an outer frame member which demarcates the entrance-side end face 301 and the outlet side end face 302 of the catalyzed combustion room 300, and demarcates the peripheral wall section 303 of the catalyzed combustion room 300. Furthermore, the container liner-like member 7 works as a seating-rim member which supports the combustion catalyst body 5 allocated by position which is different in a passage direction. In order [of the combustion catalyst body 5 / being emergency] to blow and to prevent a jump, the lattice S2 which supports the approximately whole area of the combustion catalyst body 5 is attached to the both ends of the cylindrical member 3. Here, the locking member S1 and the lattice S2 used the ceramic material of a silicon carbide system.

[0016]The plurality of the combustion catalyst body 5 can be held by this composition, permitting that thermal expansion contraction, and breakage by heat stress can be prevented. Since the hydrostatic pressure added to the combustion catalyst body 5 is not added to the combustion catalyst body 5 of the downstream one after another via a metal spacer from the upstream like before, there is also no possibility that big load may be applied as a final stage is approached. The local thermal strain which tends to happen when using the conventional metal spacer does not happen easily, either. Major-diameter-ization also becomes easy by this composition.

[0017][Other Example(s)]Important section drawing of longitudinal section and the cross-sectional view of a catalytic combustion apparatus which fit in loosely and hold the combustion catalyst body 5 of a major diameter at (b) and (**) of drawing 2 to the container liner-like member 7 and the cylindrical member 3 which comprises the **** cylindrical outer frame 8 are shown. The combustion catalyst body 5 makes the segment of the shape of a quadrant divided in the direction which intersects perpendicularly with a channel adjoin without using a binder, and is allotted and constituted in the circle configuration. Each combustion catalyst body 5 makes the attachment component S of the shape of two or more bolt radiately attached toward inside from the cylindrical member 3 (S1) contact the end face of the periphery so that movement of the thickness direction of the combustion catalyst body 5 may be prevented, and is held to the cylindrical member 3. The inside M of a figure is the radiate middle spacer made from ceramics with which the inside of the peripheral frame formed in ring shape was divided into the diameter direction and the hoop direction. This intermediate-spacers M holds the pars intermedia of the combustion catalyst body 5, being pinched by the diameter direction by the attachment component S (S1), and is carrying out the duty which secures a gap between the

combustion catalyst bodies 5 and 5. By this composition, major-diameter-ization of the combustion catalyst body 5 and the cylindrical member 3 becomes still easier.

[0018](b) and (**) of drawing 3 are also important section drawing of longitudinal section and the cross-sectional view showing the example which fits in loosely and holds the combustion catalyst body 5 of a major diameter to the container liner-like member 7 and the cylindrical member 3 which comprises the **** cylindrical outer frame 8. (**) The combustion catalyst body 5 is made the hyperfractionation composition which eight fan shape segments were made to adjoin the surroundings of a disc-like segment, without using a binder, and was allotted to disc-like [big] so that it may be shown. A wooden clapper-like locking member is made to project to an inner direction like the case of drawing 2, and the attachment component S is formed in the cylindrical member 3. Between the combustion catalyst bodies 5 and 5, the above-mentioned radiate middle spacer M is allotted. Intermediate-spacers M is not pinched by the attachment component S, but has given play to the diameter direction. the load which the load added to the periphery of the combustion catalyst body 5 is held by said attachment component S which touches the periphery, and is added to the center section of the combustion catalyst body 5 is held via said intermediate-spacers M by the periphery of the combustion catalyst body 5 by the side of a slipstream.

[0019]Drawing of longitudinal section shows another example which fits loosely into the cylindrical member 3 and holds the combustion catalyst body 5 of a major diameter to drawing 4. The cylindrical member 3 winds the cushioning heat insulating material 3b around the peripheral face of the container liner-like member which piles up two or more support cylinders 3a as a seating-rim member on shaft orientations, and is formed, and also covers and constitutes it from the griddle 3c for reinforcement as an outer frame member. There is said support cylinder 3a in the major diameter 30 of axial both ends, the narrow diameter portion 32, and the middle of these, and its inside diameter is equal to the inside diameter of said narrow diameter portion 32, An outer diameter forms in the shape which consists of the heavy-gage part 31 equal to the outer diameter of said major diameter 30, and the support cylinders 3a and 3a are piled up, and it is made the shape which can carry out inner fitting of the narrow diameter portion 32 of the support cylinder 3a of another side to the major diameter 30 of one support cylinder 3a, and can make it adjoin it. a perspective view shows to drawing 5 -- as -- said narrow diameter portion 32 -- a crosspiece -- the slot 33 to which the construction member S5 (it works as the attachment component S) of ** is allotted in parallel and into which it fits loosely is formed, this slot 33 is built over the construction member S5 in the state of permitting thermal expansion contraction, and the combustion catalyst body 5 is made to have fitted loosely into said heavy-gage part 31 It allots and the support cylinder 3a which attached the construction member S5 is piled up so that drawing 6 and the construction member S5 may cross at right angles mutually, as shown in an exploded perspective view, so that it may **** to

the combustion catalyst body 5 and movement of the thickness direction may be prevented, and the important section of the catalytic combustion apparatus of drawing 4 is constituted. The center side part of the construction member S5 is a catalyst supporter which supports the pars intermedia of the diameter direction of a combustion catalyst here. In the composition of this drawing 4, it may be made a radial as shows drawing 7 the construction member S5 which has said catalyst supporter, or the shape of a lattice as shown in drawing 8, and may form.

[0020]Now, when the sectional shape of the attachment component S shown in drawing 2, intermediate-spacers M shown in 3, drawing 4 - 8 or the construction member S5 is explained, these, A touch area with the combustion catalyst body 5 can be made as small as possible, and it is further formed in the streamline so that the flow of gas may not be affected, so that the breakthrough which forms the cell of the combustion catalyst body 5 may be blockaded, a temperature gradient may be produced in the combustion catalyst body 5 and it may not be connected with damage. That is, sectional shape is set as the rhombus. It is good also as shape as shown in drawing 9 besides rhombus shape about the sectional shape of this construction member, and the composition of a slot.

[0021]About the combination composition of the combustion catalyst body 5, composition as shown in drawing 10 (b) - (**) besides the composition shown in drawing 3 and drawing 6 is also considered. The composition shown in drawing 10 (**) and (**) in enlargement of a burner here is preferred in respect of mass production nature etc.

[0022]About how to combine each combustion catalyst body 5 and the formation direction of the cell lattice, that to which the outline of the combustion catalyst body 5 met in the direction of a cell lattice, the thing which this crosses at about 45 degrees, and the thing which combined these composition can be further considered like drawing 11. However, the result with that preferred there is a fixed relation to the composition direction of the contour shape of the combustion catalyst body 5 and a cell lattice and (**) in drawing 11 preferred about heat stress has been obtained.

[0023]About the support cylinder 3a shown in drawing 4 - drawing 8, as shown in drawing 12, this is considered as division composition in a hoop direction, and it is good also as an assembly being possible.

[0024]As for the formation direction of the cell formed in the combustion catalyst body 5, and allocation of the construction member S5, in the example shown in drawing 4 - drawing 8, it is preferred to have a specific relation. That is, as shown in drawing 13, a cell wall and the construction member S5 have 45-degree ** mutually, and are allocated. If this arrangement configuration is adopted, the area which supports the combustion catalyst body 5 by the one construction member S5 will increase, and the intensity burden of a cell wall will become small. From the cell hole which has this bar member when the construction member S5 is applied along with a cell eye by one with a small (about 1.5 mm per side) cell size of the combustion

catalyst body 5 of honeycomb composition, although it is hard to flow through gas, since the cell crevice from a member will become long if 45 degrees of cell eyes are leaned, strong resistance will not be given to a gas stream.

[0025][The example of an experiment] The combustion catalyst body 5 which comprises number 200-/in^2 of cells, and 20-mm-thick palladium cordierite One step, The combustion catalyst body 5 which comprises number 300-/in^2 of cells, and 20-mm-thick low-temperature active type manganese substitution hexa aluminate Four steps, Carried out adjacent arranging of the quadrisection segment, and it was major-diameter-ized, and two steps of the combustion catalyst body 5 which comprises number 300-/in^2 of cells and 20-mm-thick elevated-temperature heatproof type manganese substitution hexa aluminate were put in order in above order with the composition shown in drawing 4 - drawing 6, and were fitted in loosely and cassetted to the cylindrical member. The effective diameter of the combustion catalyst body 5 is 220 mm. This cassette was built into the catalytic combustion apparatus for 150kw gas turbines, and from starting by **********, it shifted to catalyzed combustion mode, and with rated load, it operated for 4 hours and stopped after that. The maximum temperature of the combustion catalyst body [in / in the temperature of the combustion catalyst body at the time of starting / 1000 ** and catalyzed combustion mode] was 1200 **, and warm-up time was about 20 seconds. The catalyzed combustion efficiency in rated load was not less than 99%. as a result, temperature up with a rapid catalytic combustion apparatus to which there are no abnormalities in the appearance of a catalyst cassette, a crack is not detected at all in observation of each catalyst body 5, but such catalyst maintenance is made, cooling, and a law -- it was proved that the heat stress in the ** combustion could be borne enough.

[0026][The example of comparative experiments] The combustion catalyst body of each stage was formed in disc-like [which carried out quadrisection adhesion with a material of the same kind / 220 mm in diameter, and 20 mm / in thickness] to the combination of the catalyst in the above-mentioned example of an experiment. As shown in drawing 14, each combustion catalyst body 5 via the metal spacer 9 of ring shape between the combustion catalyst bodies 5, It pasted up and allotted into the container liner 7 which consists of thermal insulation, and the container liner 7 was covered with the outer case 8 which consists of a metal frame, the cylindrical member 3 was formed, the same catalytic combustion apparatus as the above-mentioned example of an experiment was equipped with what was cassetted like the above-mentioned example of an experiment, and the turbine wearing examination was carried out. As a result, although the same combustion performance as the above-mentioned example of an experiment was obtained, As for the combustion catalyst body 5 which comprises the manganese substitution hexa aluminate after the 2nd step except for the combustion catalyst body 5 which comprises the 1st step of palladium cordierite, in a cohesive site or its

neighborhood, the crack development was accepted locally altogether. Therefore, in the catalytic combustion apparatus by this catalyst holding method, it turned out that long-term endurance reservation is difficult.

[0027]In order to make contrast with a drawing convenient at the paragraph of a claim, numerals are described, but this invention is not limited to the composition of an accompanying drawing by this entry.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The axial sectional view showing the example of the catalytic combustion apparatus by this invention
[Drawing 2]Important section drawing of longitudinal section and the cross-sectional view of a catalytic combustion apparatus in another example
[Drawing 3]Important section drawing of longitudinal section and the cross-sectional view of a catalytic combustion apparatus in another example
[Drawing 4]Important section drawing of longitudinal section of the catalytic combustion apparatus in another example
[Drawing 5]The important section perspective view of the catalytic combustion apparatus in drawing 4
[Drawing 6]The exploded perspective view of the important section of the catalytic combustion apparatus in drawing 4
[Drawing 7]The important section perspective view of the catalytic combustion apparatus in another example
[Drawing 8]The important section perspective view of the catalytic combustion apparatus in another example
[Drawing 9]Intermediate spacers, the figure showing the section composition of an attachment component
[Drawing 10]The figure showing the combination composition of a combustion catalyst body
[Drawing 11]The figure showing the formation relation between the outside of a combustion catalyst body, and a cell lattice
[Drawing 12]The figure showing the support cylinder of an assembled die
[Drawing 13]The figure showing the formation relation between a construction member and a cell lattice

[Drawing 14]Important section drawing of longitudinal section of the catalytic combustion apparatus in the conventional composition

[Description of Notations]

3 Cylindrical member

5 Combustion catalyst body

7 Seating-rim member

8 Outer frame member

33 Slot

300 Catalyzed combustion room

301 Entrance-side end face

302 Outlet side end face

303 Peripheral wall section

S Attachment component

S5 Construction member

[Translation done.]

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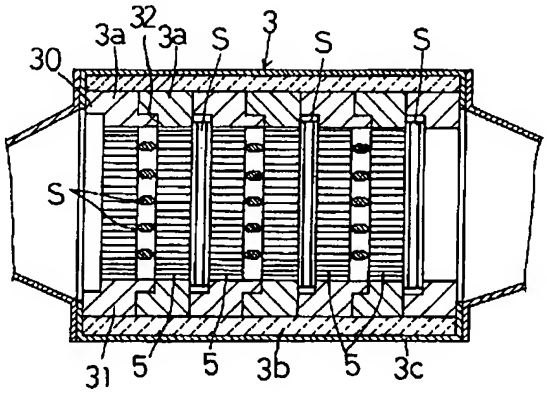
(54)【発明の名称】　触媒燃焼装置

(57)【要約】

【目的】　燃焼触媒体における熱歪等による応力の集中を少なくすると共に、後段に近い一部の燃焼触媒体に流体圧が集中することを防ぎ、ハニカム触媒のような機械的強度の小さい燃焼触媒体であっても、或いは、高温における使用条件下においても、その変形や亀裂を防止しながら、低ＮＯｘ化等の触媒性能を損なうことなく、触媒燃焼室の径を大きくして、大容量のガスを処理することのできる触媒燃焼装置を提供する。

【構成】　流路を形成する筒状部材３の内部に、流路方向に多数の貫通孔を有する複数の燃焼触媒体５を、流路方向に沿って並設した触媒燃焼装置において、燃焼触媒体５夫々を筒状部材３内に遊嵌し、燃焼触媒体５の流路方向端面に接当して、燃焼触媒体５が流路方向に移動するのを阻止する保持部材Ｓを筒状部材３に設ける。



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【特許請求の範囲】

【請求項１】　流路を形成する筒状部材（３）の内部に、前記流路方向に多数の貫通孔を有する複数の燃焼触媒体（５）を、前記流路方向に沿って並設した触媒燃焼装置であって、

前記燃焼触媒体（５）夫々を前記筒状部材（３）内に遊嵌し、前記燃焼触媒体（５）の流路方向端面に接当して、前記燃焼触媒体（５）が前記流路方向に移動するのを阻止する保持部材（Ｓ）を前記筒状部材（３）に設けてある触媒燃焼装置。

【請求項２】　前記保持部材（Ｓ）が、前記筒状部材（３）の複数箇所に掛け渡される架設部材（Ｓ５）である請求項１記載の触媒燃焼装置。

【請求項３】　前記架設部材（Ｓ５）が、端部を前記筒状部材（３）の複数箇所に設けられる溝（３３）に緩やかに嵌合されて前記筒状部材（３）に架設される請求項２記載の触媒燃焼装置。

【請求項４】　前記筒状部材（３）が、触媒燃焼室（３００）の入口側端面（３０１）と出口側端面（３０２）を画定し、且つ、前記触媒燃焼室（３００）の外周壁部（３０３）を画定する外枠部材（８）と、前記外枠部材（８）の内部側に配設され、且つ、前記流路方向に複数個並設されて、前記入口側端面（３０１）と出口側端面（３０２）との間に挟持される内枠部材（７）から構成され、上流側の前記内枠部材（７）が下流側の内枠部材（７）により流路方向で位置保持されるとともに、前記内枠部材（７）の夫々が前記流路方向で異なった位置に配設される前記燃焼触媒体（５）夫々を個別に前記架設部材（Ｓ５）を介して支持する請求項２または３記載の触媒燃焼装置。

【請求項５】　複数の前記架設部材（Ｓ５）が直線棒状部材から構成され、上流側に配設される前記架設部材（Ｓ５）が下流側に配設される前記架設部材（Ｓ５）に対して９０度位相を異にして配設されている請求項２，３又は４記載の触媒燃焼装置。

【請求項６】　前記燃焼触媒体（５）が、流路に直交する方向で複数に分割形成されたものである請求項２，３，４又は５記載の触媒燃焼装置。

【請求項７】　前記保持部材（Ｓ）が燃焼触媒体（５）の外周部位を支持するのみならず、前記燃焼触媒体（５）の中心側部位をも支持する触媒支持部を備えている請求項１記載の触媒燃焼装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】燃焼機器から発生するＮＯｘによる環境汚染の進行から、燃焼プロセスにおける大幅なＮＯｘ抑制手段の開発が望まれている。そのＮＯｘ抑制手段の一つとして、流路方向に多数の貫通孔を有するハニカム形状の燃焼触媒を用いる予混合触媒燃焼法は、１１００～１３００℃の温度で、ＮＯｘの発生を極度に抑制しながら、安定燃焼を達成できることが知られている。この特徴を、ガスタービンの超低ＮＯｘ達成手段として、又、燃料電池の排出燃料、空気混合気を再燃焼する手段として利用することが、あるいは、ボイラ、工業用バーナ等への応用が検討されている。本発明は、流路を形成する筒状部材の内部に、流路方向に多数の貫通孔を有する複数の燃焼触媒体を、流路方向に沿って並設した触媒燃焼装置に関し、例えば、上述のような低ＮＯｘ用の触媒燃焼装置に関する。

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【０００２】

【従来の技術】従来、パラジウム、白金等の貴金属をアルミナ等のコーティング材を介してコーディエライトハニカム基体に担持した板状の燃焼触媒体の開発が為されてきている。コーディエライトハニカム基体は、熱膨張率を約１．４×１０$^{-6}$／℃とかなり低くできる材料であるが、最高使用温度は１４００℃以下とされ、高温使用には問題がある。また、この構成の触媒では、１０００℃を超えると、貴金属が蒸発揮散すること、コーティング材の焼結進行による比表面積の低下を起こすこと等により、活性劣化が起こる等の問題があった。

【０００３】そこで、本件発明者等は、パラジウム・コーディエライト燃焼触媒体を前段の低温部に用い、中段から後段の高温部に、マンガン置換型層状アルミネート触媒体を配置した触媒燃焼装置を提案している。マンガン置換型層状アルミネート触媒体は融点が１６００℃以上であり、１３００℃においても、長期にわたって高比表面積を保ち、高活性を維持しやすい特徴を有している。

【０００４】従来このような構造体において、燃焼触媒体は、それぞれ、流路方向に垂直な断面全体を覆う板状に形成し、その周囲を筒状部材に接着した状態で、これを流路方向に、間隙をおいて、並べて配されていた。これらの間隙は、各触媒体の厚さを制限し、厚み方向の温度差を少なくして熱応力を小さく抑える役目をすると共に各触媒体間の貫通孔のずれによる通気抵抗の増加を防ぐ役目もしている。

【０００５】

【発明が解決しようとする課題】ところが、燃焼触媒体を、その周囲を筒状部材に接着した状態で筒状部材に固定すると、温度変化に追従して燃焼触媒体が自由に膨張収縮することが妨げられるために、熱応力が生じて燃焼触媒体が破損する虞があった。この対応策として、図１４に示すように、燃焼触媒体の周囲を筒状部材３に接着せずに遊嵌させると共に、例えば、筒状部材内の隣合う燃焼触媒体５間にリング状の金属スペーサー９を遊嵌させて前記間隙を確保することにより、前記熱応力を逃す試みもなされているが、このような構成では、燃焼触媒体５に加わる流体圧が上流側より金属スペーサー９を介して次々に下流側の燃焼触媒体５に加算され、最終段の燃焼触媒体５に大きな力が集中してこれを破損する危険

性があった。又、燃焼触媒体５に金属スペーサー９が当接する部分と、当接しない部分とで温度の違いを生じやすく、これが前記破損を助長する虞もあった。

【０００６】又、上記の高温燃焼触媒体を、より実用的なものとするためには、燃焼の大容量化を図る必要がある。そこで、低ＮＯｘ化の性能を損なうことなく、燃焼触媒体５のガス処理量を大きくするには、触媒体の面積を大きくする必要があるが、ハニカムの寸法精度と強度を維持しながら、一体成形できる大きさには自ずから限界がある。例えば、強度のみならず高活性が必要とされ、１平方インチ当りセル数２００以上が必要である燃焼触媒体では、直径２００ｍｍもしくは２００ｍｍ角程度の大きさが限界とされている。

【０００７】そこで、これまでに、例えば、小型の触媒燃焼装置を製作して、マルチ型に並列に接続する方法、或は、２００ｍｍ径相当の大きさ以内の大きさのハニカム触媒のセグメントの複数を接着もしくは接合して断面積を増大させる方法により、大容量化を図る検討がなされている。

【０００８】しかしながら、前者の並列に接続するマルチ型の触媒燃焼装置は、装置全体が大きく複雑になるためコスト高となり、保守管理も容易でない。従って実用性に乏しい。後者の接合法は、接着のために燃焼触媒体とは異なる材料を用いる方法であるが、燃焼触媒体は１０００℃を越える温度で使用されるので、両者の固相反応により、接合部の劣化を起こしやすい欠点があった。又、同種の材料を用いた接着方法は、材料間の固層反応が抑制できること、材料自体の熱膨張率を同一にできること等の利点があるものの、接着部位の厚みはセルの壁厚と同等にすることが困難であり、接着面の長さが大きい程、厚みの不均一性に起因して、機械的強度や温度分布が不均一となり、このため、接着部位付近において、亀裂が発生しやすい問題があった。この問題は、熱膨張率が６～８×１０$^{-6}$／℃とコーディエライトハニカムの燃焼触媒体よりも大きいマンガン置換層状アルミネートの燃焼触媒体において、熱応力が数倍高くなるので特に重要である。

【０００９】尚、金属スペーサーとハニカム触媒の熱膨張係数や熱伝導度の違い、或は機械的強度の違いに起因する応力の集中によっても、ハニカム触媒を損傷する虞がある。

【００１０】本発明の目的は、燃焼触媒体における前記熱歪等による応力の集中を少なくすると共に、後段に近い一部の燃焼触媒体に流体圧が集中することを防ぎ、更に、例えば上述のハニカム触媒のような機械的強度の小さい燃焼触媒体であっても、或いは、高温における使用条件下においても、その変形や亀裂を防止しながら、低ＮＯｘ化等の触媒性能を損なうことなく、触媒燃焼室の径を大きくして、大容量のガスを処理することのできる触媒燃焼装置を提供することにある。

【００１１】

【課題を解決するための手段】この目的を達成するため、本発明による触媒燃焼装置の特徴構成は、燃焼触媒体夫々を筒状部材内に遊嵌し、燃焼触媒体の流路方向端面に接当して、燃焼触媒体が流路方向に移動するのを阻止する保持部材を筒状部材に設けてあることにある。

【００１２】

【作用】燃焼触媒体夫々を筒状部材内に遊嵌し、燃焼触媒体の流路方向の端面に接当して燃焼触媒体がその厚み方向に移動するのを阻止する保持部材を筒状部材に設けると、燃焼触媒体は周囲を拘束されず、熱による膨張収縮が許容されるので、燃焼触媒体に熱応力が生じにくい。更に、各燃焼触媒体に加わる流体圧は、その燃焼触媒体を支持する保持部材によって受け止められるので、触媒体も金属スペーサーも筒状部材に遊嵌させる従来の構成における場合のように、燃焼触媒体に加わる流体圧が上流側より金属スペーサーを介して次々に下流側の燃焼触媒体に加算され、最終段の燃焼触媒体に大きな力が集中してこれを破損する危険を避けることができる。保持部材は、例えば燃焼触媒体の周部の複数箇所を支持するだけの構成でも、上述の理由で破損の虞が少なくなるから、ある程度大口径化が容易になるが、保持部材に燃焼触媒体の径方向の中心側部を支持する触媒支持部を形成してあると、燃焼触媒体の破損を防止しながら、大きさに制限のある燃焼触媒体を組合わせて、触媒燃焼部の断面を大口径化することが容易になる。例えば、一体成形では形成できないような大型の燃焼触媒体（複数の成型可能な燃焼触媒体を板状に組み合わしたもの）を構成するのに、対応する大口径筒状部材の流路に垂直な円形断面を複数個に分割した形状のセグメントを個別に成形し、これらを接着剤を用いずに突き合わせて所定の形にしたものを、前記大口径の筒状部材に遊嵌して保持することもできる。その際、保持部材を、筒状部材の複数箇所に掛け渡した部材で形成すると、保持部材に触媒支持部を形成しやすいので、燃焼触媒体の大径化がより容易になる。又、保持部材の端部を筒状部材の複数箇所に形成された溝部に緩やかに嵌合させて筒状部材に架設すると、保持部材の熱膨張収縮が許容されるので、例えばセラミック製の保持部材を用いても、保持部材自体を熱応力による破損から守ることができる。

【００１３】

【発明の効果】従来は接着剤や金属製スペーサーを用いて確保していた燃焼触媒体間の間隙を、本願では保持部材によって確保することができるので、この間隙によって、各燃焼触媒体間の貫通孔のずれによる通気抵抗の増加も防ぐことができながら、保持部材により、各燃焼触媒体自体を、その熱膨張を許容する状態で保持できるので、これに熱応力が発生することを防止できる。従って燃焼触媒体の熱応力による破損を防止することが容易になる。又、燃焼触媒体に加わる流体圧が上流側より金属

スペーサーを介して次々に下流側の燃焼触媒体に加算され、最終段の燃焼触媒体に大きな力が集中してこれが破損してしまうという危険性を避けることができる。更に又、複数のセグメントを比較的小さな接着面または接合面で合わせて、或は接着剤等を使わずに突き合わせるだけで大きな触媒体を形成しても、これを保持部材によって、その熱膨張を許容する状態で保持できるので、熱応力が発生することを防止できる。つまり、大容量の燃焼装置であっても、燃焼触媒体を比較的小さなセグメントに分割して構成することができるので、一体で大きな燃焼触媒体に比べて、各セグメントは膨張率が同じでも膨張量が小さくなり、このことによっても、熱応力による破壊は起こりにくくなる。

【００１４】その結果、例えばハニカム触媒のような機械的強度の小さい燃焼触媒体であっても、熱歪等による応力の集中を少なくして破損を防止しながら、低ＮＯｘ化等、触媒自体の性能を損なうことなく、筒状部材の径を大きくして、大容量のガスを処理することのできる触媒燃焼装置を提供することができた。

【００１５】

【実施例】以下、図に基づいて本発明による触媒燃焼装置の実施例を説明する。図１に触媒燃焼装置の軸方向断面を示す。触媒燃焼装置は、燃焼ガスの流路に沿って、予熱用燃焼室１と、希薄燃料ガスの混合室２と、筒状部材３により形成される触媒燃焼室３００と、燃焼ガスの排出部４とを順に設け、厚さ方向に多数の貫通孔を有するハニカム触媒から成る円板状の燃焼触媒体５の複数を前記筒状部材３内に流路に沿って並べて配してある。筒状部材３は、高温耐熱セラミック繊維を圧縮成形した内筒状部材７を鉄製円筒状外枠８で補強する構成にしてある。各燃焼触媒体５は、前記筒状部材３に遊嵌されるとともに、内筒状部材７を貫通して内部に突出する複数のボルト状の係止部材Ｓ１を前記筒状部材３に取り付けて燃焼触媒体５に対する保持部材Ｓとして形成してあり、前記保持部材Ｓを燃焼触媒体５の端面に接当させて、燃焼触媒体５がその厚み方向に移動するのを阻止するようにしてある。　ここで、鉄製円筒状外枠８は触媒燃焼室３００の入口側端面３０１と出口側端面３０２を画定し、且つ、触媒燃焼室３００の外周壁部３０３を画定する外枠部材として働く。さらに内筒状部材７は流路方向で異なった位置に配設される燃焼触媒体５を支持する内枠部材として働く。さらに、筒状部材３の両端部には、燃焼触媒体５の万一の吹き飛びを防止するために、燃焼触媒体５の略全面を支持する格子Ｓ２を取付けてある。ここで、係止部材Ｓ１、格子Ｓ２はシリコンカーバイド系のセラミック材を用いた。

【００１６】この構成によって、燃焼触媒体５の複数を、その熱膨張収縮を許容しながら保持することができ、熱応力による破損を防止することができる。又、燃焼触媒体５に加わる流体圧が従来のように上流側より金属スペーサーを介して次々に下流側の燃焼触媒体５に加算されることがないから、最終段に近づくにつれて大きな荷重がかかるという虞もない。又、従来の金属スペーサーを用いる場合に起こりがちな局部的な熱歪も起こりにくい。この構成によって大径化も容易になる。

【００１７】〔別実施例〕図２の（イ）と（ロ）に、大径の燃焼触媒体５を内筒状部材７と鉄装円筒状外枠８から成る筒状部材３に遊嵌して保持する触媒燃焼装置の要部縦断面図と横断面図を示す。燃焼触媒体５は流路に直交する方向に分割した四分円状のセグメントを接着材を用いずに隣接させて円形状に配して構成してある。各燃焼触媒体５は、筒状部材３から放射状に内に向かって取り付けられた複数のボルト状の保持部材Ｓ（Ｓ１）を、燃焼触媒体５の厚み方向の移動を阻止するように、その周辺部の端面に当接させて、筒状部材３に保持してある。図中Ｍはリング状に形成した外周枠内を径方向と周方向に仕切った放射状のセラミック製中間スペーサーである。この中間スペーサーＭは、保持部材Ｓ（Ｓ１）によって径方向に挟持されながら燃焼触媒体５の中間部を保持して、燃焼触媒体５，５間に間隙を確保する役目をしている。この構成によって、燃焼触媒体５及び筒状部材３の大径化がさらに容易になる。

【００１８】図３の（イ）と（ロ）も、大径の燃焼触媒体５を内筒状部材７と鉄装円筒状外枠８から成る筒状部材３に遊嵌して保持する例を示す要部縦断面図と横断面図である。（ロ）に示すように燃焼触媒体５は円板状のセグメントのまわりに８個の扇形状セグメントを接着材を用いずに隣接させて大きな円板状に配した多分割構成にしてある。筒状部材３には、図２の場合と同様にして拍子木状の係止部材を内方に突出させて保持部材Ｓを形成してある。燃焼触媒体５，５間には上述の放射状の中間スペーサーＭを配してある。中間スペーサーＭは保持部材Ｓによって挟持せず、径方向に遊びを持たせてある。燃焼触媒体５の周辺部に加わる荷重は、その周辺部に接する前記保持部材Ｓによって保持され、燃焼触媒体５の中央部に加わる荷重は、前記中間スペーサーＭを介して後流側の燃焼触媒体５の周辺部で保持される。

【００１９】図４に、大径の燃焼触媒体５を筒状部材３に遊嵌して保持する別の実施例を縦断面図で示す。筒状部材３は、内枠部材としての複数の支持円筒３ａを軸方向に重ねあわせて形成される内筒状部材の外周面に緩衝断熱材３ｂを巻き、更に外枠部材としての補強用鉄板３ｃで覆って構成してある。前記支持円筒３ａは軸方向両端部の大径部３０と小径部３２と、これらの中間にあって内径が前記小径部３２の内径と等しく、外径が前記大径部３０の外径と等しい厚肉部３１とからなる形状に形成し、且つ支持円筒３ａ，３ａを重ねあわせて、一方の支持円筒３ａの大径部３０に、他方の支持円筒３ａの小径部３２を内嵌して隣接させることができる形状にしてある。図５に斜視図で示すように、前記小径部３２に

は、桟状の架設部材Ｓ５（保持部材Ｓとして働く）を平行に配して遊嵌する溝３３を形成し、この溝３３に架設部材Ｓ５を、熱膨張収縮を許容する状態で掛け渡すと共に、前記厚肉部３１に燃焼触媒体５を遊嵌させてある。さらに、燃焼触媒体５に接当してその厚み方向の移動を阻止するように架設部材Ｓ５を取り付けた支持円筒３ａを、図６に分解斜視図で示すように、架設部材Ｓ５が互いに直交するように配して重ね合わせて、図４の触媒燃焼装置の要部が構成される。ここで架設部材Ｓ５の中心側部位は燃焼触媒の径方向の中間部を支持する触媒支持部になっている。この図４の構成において、前記触媒支持部を有する架設部材Ｓ５を例えば図７に示すような放射状、或は図８に示すような格子状にして形成してもよい。

【００２０】さて、図２、３に示す中間スペーサＭ、図４～８に示す保持部材Ｓ或いは架設部材Ｓ５の断面形状について説明すると、これらは、燃焼触媒体５のセルを形成する貫通孔を閉塞して、燃焼触媒体５内に温度差を生じて損傷に結びつかないように、燃焼触媒体５との接触面積をできるだけ小さくでき、さらに、ガスの流れに影響を与えないように流線形に形成されている。即ち、断面形状が菱形に設定されている。この架設部材の断面形状及び溝の構成に関しては、菱形形状の他、図９に示すような形状としてもよい。

【００２１】さらに、燃焼触媒体５の組み合わせ構成については、図３、図６に示す構成の他、図１０（イ）～（ヘ）に示すような構成も考えられる。ここで、燃焼装置の大型化に当たっては、図１０（ロ）及び（ニ）に示す構成が、量産性等の点で好ましい。

【００２２】さらに、個々の燃焼触媒体５の組み合わせかたと、そのセル格子の形成方向については、図１１のように、燃焼触媒体５の外形線がセル格子の方向に沿ったもの、これとはほぼ４５度で交わるもの、さらに、これらの構成を組み合わせたものが考えられる。但し、燃焼触媒体５の外形形状とセル格子の構成方向に一定の関係があることが好ましく、図１１中（ハ）が熱応力については好ましい結果を得ている。

【００２３】さらに、図４～図８に示す支持円筒３ａについては、図１２に示すようにこれを、周方向に分割構成とし、組み立て可能としてもよい。

【００２４】さらに、図４～図８に示す実施例において、燃焼触媒体５に形成されるセルの形成方向と、架設部材Ｓ５の配設とは、特定の関係にあることが好ましい。即ち、図１３に示す様にセル壁と、架設部材Ｓ５とは、互いに４５°の傾をもって配設されている。この配置構成を採用すると、１本の架設部材Ｓ５で燃焼触媒体５を支持する面積が増え、セル壁の強度負担は小さくなる。ハニカム構成の燃焼触媒体５のセル寸法が小さい（１辺約１．５ｍｍ）ので、セル目に沿って架設部材Ｓ５をあてるとこの棒状部材のあるセル穴からは、ガスが流れにくいが、セル目を４５°傾けると部材からのセル隙間が長くなるのでガス流に大きな抵抗を与えなくなる。

【００２５】〔実験例〕セル数２００／ｉｎ²、厚さ２０ｍｍのパラジウムコーディエライトから成る燃焼触媒体５を１段と、セル数３００／ｉｎ²、厚さ２０ｍｍの低温活性型マンガン置換ヘキサアルミネートから成る燃焼触媒体５を４段と、セル数３００／ｉｎ²、厚さ２０ｍｍの高温耐熱型マンガン置換ヘキサアルミネートから成る燃焼触媒体５の２段を、４分割セグメントを隣接配置して大径化すると共に、図４～図６に示す構成で上記の順に並べ、筒状部材に遊嵌してカセット化した。燃焼触媒体５の有効直径は２２０ｍｍである。このカセットを１５０ｋｗガスタービン用触媒燃焼装置に組み込み、予燃焼モードによる起動から、触媒燃焼モードに移行し、定格負荷で４時間運転し、その後停止した。起動時の燃焼触媒体の温度は１０００℃、触媒燃焼モードにおける燃焼触媒体の最高温度は１２００℃、起動時間は約２０秒であった。定格負荷における触媒燃焼効率は９９％以上であった。この結果、触媒カセットの外観に全く異常がなく、又、各触媒体５の観察において、亀裂は全く検知されず、このような触媒保持のできる触媒燃焼装置が、急激な昇温、冷却、又、定状燃焼における熱応力に充分耐えられることが実証された。

【００２６】〔比較実験例〕上記実験例における触媒の組合せに対し、各段の燃焼触媒体を、同種材料で４分割接着した直径２２０ｍｍ、厚さ２０ｍｍの円板状に形成した。各燃焼触媒体５を図１４に示すように、燃焼触媒体５間にリング状の金属スペーサー９を介して、断熱材からなる内筒７中に接着して配し、内筒７を金属枠からなる外筒８で覆って筒状部材３を形成し、上記実験例と同様にカセット化したものを上記実験例と同様の触媒燃焼装置に装着し、タービン装着試験を実施した。この結果、上記実験例と同様の燃焼性能が得られたが、１段目のパラジウムコーディエライトから成る燃焼触媒体５を除いて、２段目以降のマンガン置換ヘキサアルミネートから成る燃焼触媒体５はすべて、接着部位もしくはその付近において、局部的に亀裂発生が認められた。従って、この触媒保持方法による触媒燃焼装置では長期の耐久性確保は困難であることがわかった。

【００２７】尚、特許請求の範囲の項に図面との対照を便利にするために符号を記すが、該記入により本発明は添付図面の構成に限定されるものではない。

【図面の簡単な説明】

【図１】本発明による触媒燃焼装置の実施例を示す軸方向断面図

【図２】別実施例における触媒燃焼装置の要部縦断面図と横断面図

【図３】別実施例における触媒燃焼装置の要部縦断面図と横断面図

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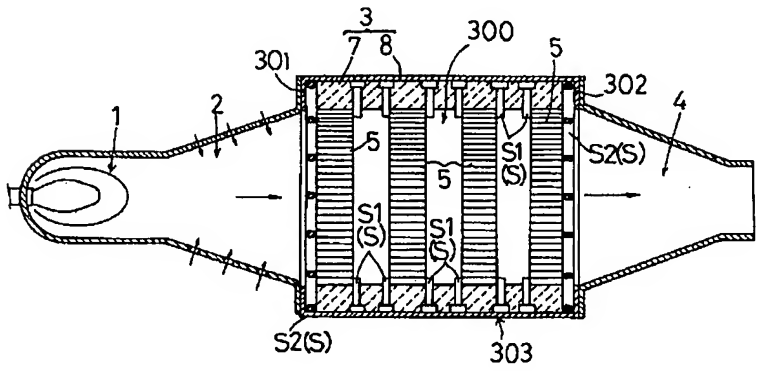
【図４】別実施例における触媒燃焼装置の要部縦断面図
【図５】図４における触媒燃焼装置の要部斜視図
【図６】図４における触媒燃焼装置の要部の分解斜視図
【図７】別実施例における触媒燃焼装置の要部斜視図
【図８】別実施例における触媒燃焼装置の要部斜視図
【図９】中間スペーサ、保持部材の断面構成を示す図
【図１０】燃焼触媒体の組み合わせ構成を示す図
【図１１】燃焼触媒体の外形とセル格子の形成関係を示す図
【図１２】分割型の支持円筒を示す図
【図１３】架設部材とセル格子の形成関係を示す図
【図１４】従来の構成における触媒燃焼装置の要部縦断面図

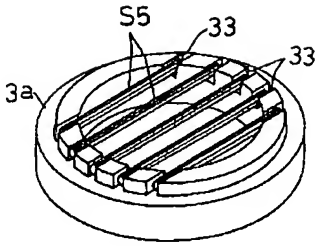
＊【符号の説明】

3	筒状部材
5	燃焼触媒体
7	内枠部材
8	外枠部材
３３	溝
３００	触媒燃焼室
３０１	入口側端面
３０２	出口側端面
３０３	外周壁部
S	保持部材
Ｓ５	架設部材

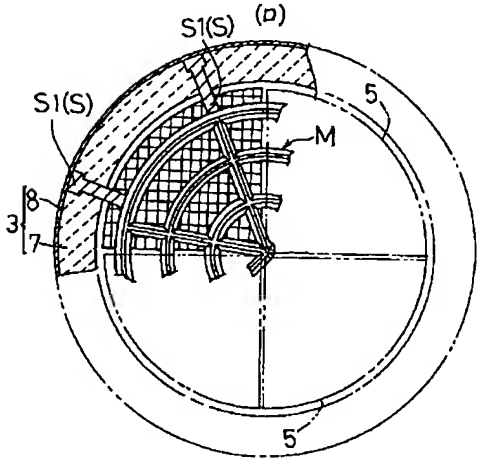
【図１】

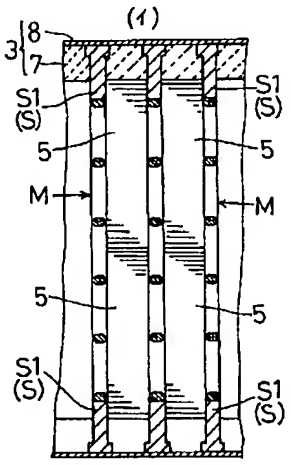


【図５】

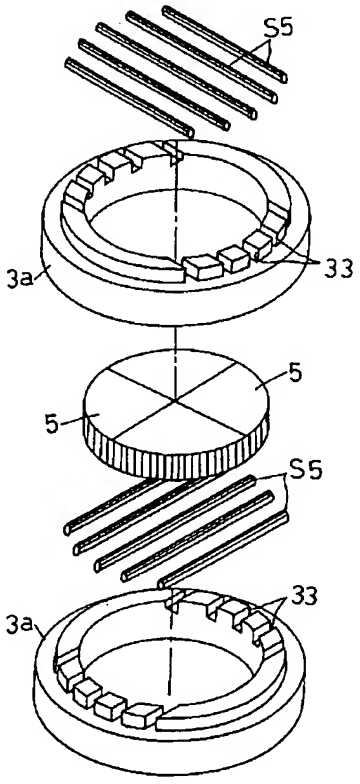


【図２】

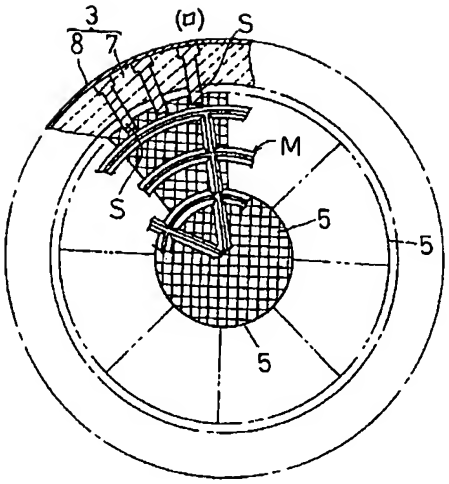


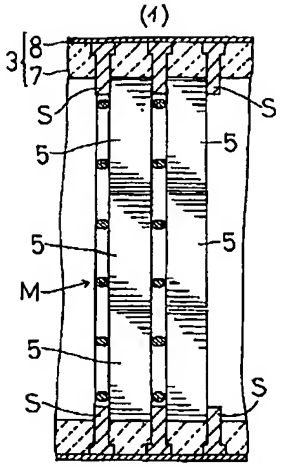


【図６】

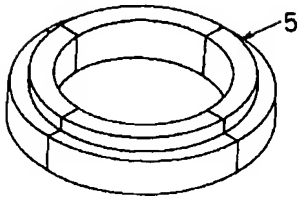


【図３】

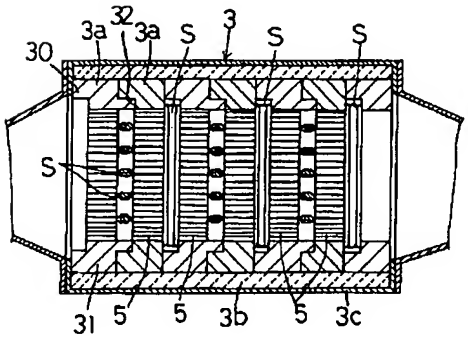




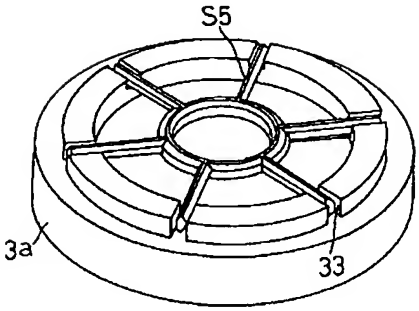
【図１２】



【図４】



【図７】



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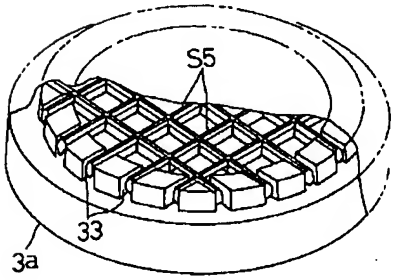

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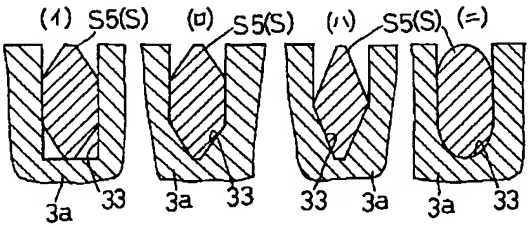
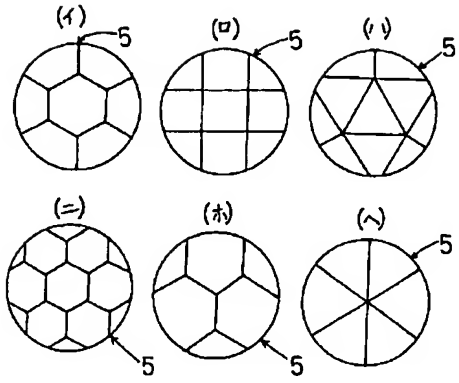
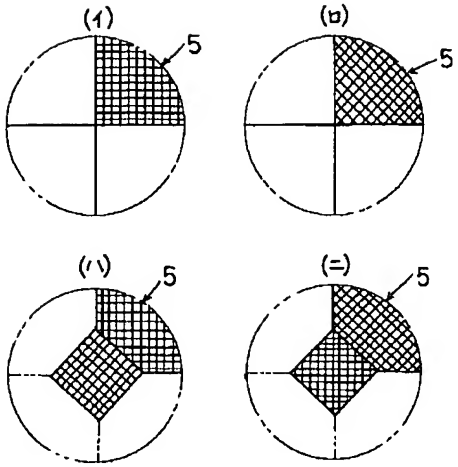


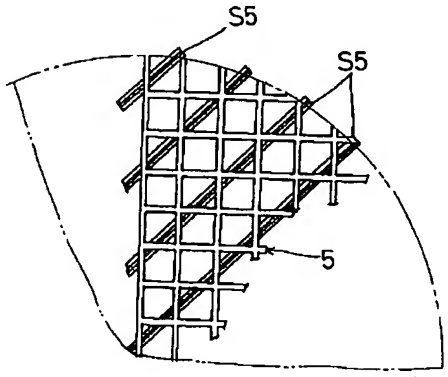
【図１０】



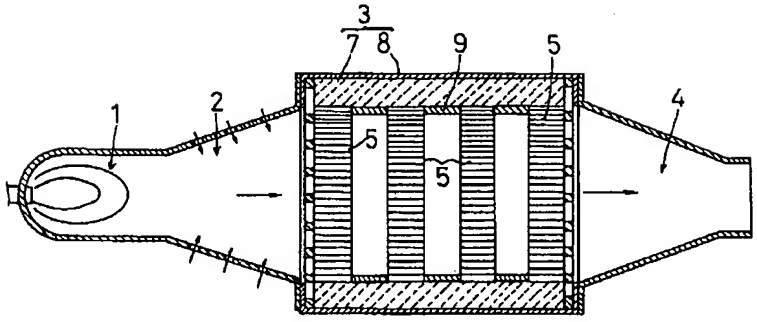
【図１１】



【図１３】



【図１４】



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